

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 30 January 2001 (30.01.01)	
International application No. PCT/EP99/03875	Applicant's or agent's file reference WO 23999
International filing date (day/month/year) 04 June 1999 (04.06.99)	Priority date (day/month/year)
Applicant BERGENWALL, Martin	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
23 November 2000 (23.11.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Olivia TEFY Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

PELLMANN, Hans-Bernd
Tiedtke-Bühling-Kinne
Bavariaring 4
D-80336 München
ALLEMAGNEDate of mailing (day/month/year)
23 janvier 2002 (23.01.02)Applicant's or agent's file reference
WO 23999

IMPORTANT NOTIFICATION

International application No.
PCT/EP99/03875International filing date (day/month/year)
04 juin 1999 (04.06.99)

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address

NOKIA NETWORKS OY
Keilalahdentie 4
FIN-02150 Espoo
FinlandState of Nationality
FIState of Residence
FITelephone No.
+358 9 1807 0Facsimile No.
+358 9 1807 496

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☒ the name ☐ the address ☐ the nationality ☐ the residence

Name and Address

NOKIA CORPORATION
Keilalahdentie 4
FIN-02150 Espoo
FinlandState of Nationality
FIState of Residence
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+358 9 1807 0Facsimile No.
+358 9 1807 496

Teleprinter No.

3. Further observations, if necessary:

Change of applicant's name (merger) has been recorded.

4. A copy of this notification has been sent to:

☒ the receiving Office ☐ the designated Offices concerned
☐ the International Searching Authority ☒ the elected Offices concerned
☒ the International Preliminary Examining Authority ☐ other:The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

R. Chrem

Facsimile No.: (41-22) 740.14.35

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

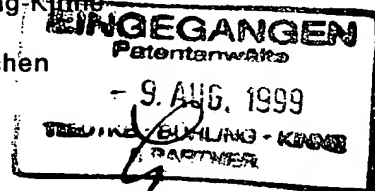
PCT

NOTIFICATION OF RECEIPT OF
RECORD COPY

(PCT Rule 24.2(a))

To:

PELLMANN, Hans-Bernd
Tiedtke-Bühling-Kinne
Bavariaring 4
D-80336 München
ALLEMAGNE



Date of mailing (day/month/year) 28 July 1999 (28.07.99)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference WO 23999	International application No. PCT/EP99/03875

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

NOKIA TELECOMMUNICATIONS OY (for all designated States except US)
BERGENWALL, Martin (for US)

International filing date : 04 June 1999 (04.06.99)

Priority date(s) claimed :

Date of receipt of the record copy
by the international Bureau : 13 July 1999 (13.07.99)

List of designated Offices :

AP : GH,GM,KE,LS,MW,SD,SL,SZ,UG,ZW

EA : AM,AZ,BY,KG,KZ,MD,RU,TJ,TM

EP : AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE

OA : BF,BJ,CF,CG,CI,CM,GA,GN,GW,ML,MR,NE,SN,TD,TG

National : AE,AL,AM,AT,AU,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CU,CZ,DE,DK,EE,ES,FI,GB,GD,GE,
GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KP,KR,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,
NO,NZ,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,UA,UG,US,UZ,VN,YU,ZA,ZW

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- ☒ time limits for entry into the national phase
☐ confirmation of precautionary designations
☐ requirements regarding priority documents

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. (41-22) 740.14.35</p>	<p>Authorized officer: P. Regis</p> <p>Telephone No. (41-22) 338.83.38</p>
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INFORMATION ON TIME LIMITS FOR ENTERING THE NATIONAL PHASE

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated in the Notification of Receipt of Record Copy (Form PCT/IB/301) by paying national fees and furnishing translations, as prescribed by the applicable national laws.

The time limit for performing these procedural acts is **20 MONTHS** from the priority date or, for those designated States which the applicant elects in a demand for international preliminary examination or in a later election, **30 MONTHS** from the priority date, provided that the election is made before the expiration of 19 months from the priority date. Some designated (or elected) Offices have fixed time limits which expire even later than 20 or 30 months from the priority date. In other Offices an extension of time or grace period, in some cases upon payment of an additional fee, is available.

In addition to these procedural acts, the applicant may also have to comply with other special requirements applicable in certain Offices. It is the applicant's responsibility to ensure that the necessary steps to enter the national phase are taken in a timely fashion. Most designated Offices do not issue reminders to applicants in connection with the entry into the national phase.

For detailed information about the procedural acts to be performed to enter the national phase before each designated Office, the applicable time limits and possible extensions of time or grace periods, and any other requirements, see the relevant Chapters of Volume II of the PCT Applicant's Guide. Information about the requirements for filing a demand for international preliminary examination is set out in Chapter IX of Volume I of the PCT Applicant's Guide.

GR and ES became bound by PCT Chapter II on 7 September 1996 and 6 September 1997, respectively, and may, therefore, be elected in a demand or a later election filed on or after 7 September 1996 and 6 September 1997, respectively, regardless of the filing date of the international application. (See second paragraph above.)

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

CONFIRMATION OF PRECAUTIONARY DESIGNATIONS

This notification lists only specific designations made under Rule 4.9(a) in the request. It is important to check that these designations are correct. Errors in designations can be corrected where precautionary designations have been made under Rule 4.9(b). The applicant is hereby reminded that any precautionary designations may be confirmed according to Rule 4.9(c) before the expiration of 15 months from the priority date. If it is not confirmed, it will automatically be regarded as withdrawn by the applicant. There will be no reminder and no invitation. Confirmation of a designation consists of the filing of a notice specifying the designated State concerned (with an indication of the kind of protection or treatment desired) and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.

REQUIREMENTS REGARDING PRIORITY DOCUMENTS

For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ("the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau, before the expiration of 16 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application, in which case that document will be considered to have been received by the International Bureau on the last day of the 16-month time limit (Rule 17.1(a)).

Where the priority document is issued by the receiving Office, the applicant may, instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 16-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17.1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any, paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim, provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity to furnish the priority document within a time limit which is reasonable under the circumstances.

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 16-month time limit is the filing date of the earliest application whose priority is claimed.

PATENT COOPERATION TREATY

PCT/EP99/03875

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

PELLMANN, Hans-Bernd
Tiedtke-Bühling-Kinne
Bavariaring 4
D-80336 München
ALLEMAGNE

GEHANGEN
Patentanwalt

17. DEZ. 1999

**TIEDTKE - BÜHLING - KINNE
& PARTNER**

Date of mailing (day/month/year) 08 December 1999 (08.12.99)	Applicant's or agent's file reference WO 23999
International application No. PCT/EP99/03875	International filing date (day/month/year) 04 June 1999 (04.06.99)

IMPORTANT NOTIFICATION

1. The following indications appeared on record concerning:

☒ the applicant
 ☐ the inventor
 ☐ the agent
 ☐ the common representative

Name and Address

NOKIA TELECOMMUNICATIONS OY
Keilalahdentie 4
FIN-02150 Espoo
Finland

State of Nationality

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State of Residence

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Telephone No.

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Facsimile No.

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Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person
 ☒ the name
 ☐ the address
 ☐ the nationality
 ☐ the residence

Name and Address

NOKIA NETWORKS OY
Keilalahdentie 4
FIN-02150 Espoo
Finland

State of Nationality

FI

State of Residence

FI

Telephone No.

+358 9 1807 0

Facsimile No.

+358 9 1807 496

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒ the receiving Office
 ☐ the designated Offices concerned
☒ the International Searching Authority
 ☐ the elected Offices concerned
☐ the International Preliminary Examining Authority
 ☐ other:

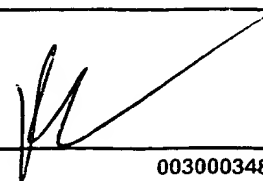
The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

P. Regis

Telephone No.: (41-22) 338.83.38



PCT

**NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES**

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:
PELLMANN, Hans-Bernd
Tiedtke-Bühling-Kinne
Bavariaring 4
D-80336 München
ALLEMAGNE

EINGEGANGEN
Patentanwälte
27. Dez. 2000
TIEDTKE · BÜHLING · KINNE
& PARTNER (GmbH)

Date of mailing (day/month/year) 14 December 2000 (14.12.00)		
Applicant's or agent's file reference WO 23999		IMPORTANT NOTICE
International application No. PCT/EP99/03875	International filing date (day/month/year) 04 June 1999 (04.06.99)	
Priority date (day/month/year)		
Applicant NOKIA NETWORKS OY et al		

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CU,CZ,DE,DK,EA,EE,EP,ES,FI,GB,GD,GE,GH,
GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NO,NZ,OA,
PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,UA,UG,UZ,VN,YU,ZA,ZW
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
14 December 2000 (14.12.00) under No. WO 00/76139

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PCT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

INFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

To:

PELLMANN, Hans-Bernd
Tiedtke-Bühling-Kinne
Bavariaring 4
D-80336 München - 5. Feb. 2001
ALLEMAGNE
EINGEGANGEN
TIEDTKE · BÜHLING · KINNE
& PARTNER (GmbH)

Date of mailing (day/month/year) 30 January 2001 (30.01.01)		
Applicant's or agent's file reference WO 23999		IMPORTANT INFORMATION
International application No. PCT/EP99/03875	International filing date (day/month/year) 04 June 1999 (04.06.99)	
Priority date (day/month/year)		
Applicant NOKIA NETWORKS OY et al		

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP : GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

National : AU, BG, CA, CN, CZ, DE, IL, JP, KP, KR, MN, NO, NZ, PL, RO, RU, SE, SK, US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG

National : AE, AL, AM, AT, AZ, BA, BB, BR, BY, CH, CU, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IN, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MW, MX, PT, SD, SG, SI, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer: Olivia TEFY Telephone No. (41-22) 338.83.38
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TBK

TILLOTKE - BÜHLING - KINNE & PARTNER (GmbH)

09/980075

Rec'd PCT/PTO 28 NOV 2001

TBK-Patent POB 20 19 18 80019 München

An das
Europäische Patentamt

80298 München

Patentanwälte

Dipl.-Ing. Harro Tiedtke
Dipl.-Ing. Reinhard Kinne
Dipl.-Ing. Hans-Bernd Pellmann
Dipl.-Ing. Klaus Grams
Dipl.-Ing. Aurel Vollnhals
Dipl.-Ing. Thomas J.A. Leson
Dipl.-Ing. Dr. Georgi Chivarov
Dipl.-Ing. Matthias Grill
Dipl.-Ing. Hans-Ludwig Trösch
Dipl.-Ing. Alexander Kühn
Dipl.-Chem. Dr. Andreas Oser
Dipl.-Ing. Rainer Böckelen
Dipl.-Ing. Stefan Klingele
Dipl.-Chem. Stefan Bühling
Dipl.-Ing. Ronald Roth

PCT Chapter II

June 25, 2001

PCT Patent Application No.: PCT/EP99/03875
NOKIA NETWORKS OY
Our ref.: WO 23999

(F: 3.7. Eing.)

Reference is made to the Written Opinion of April 3, 2001.

Enclosed new claims 1 to 11 replacing the original claim version are filed, upon which the further prosecution of the application is based.

Moreover, new pages 4, 5 and 9 of a revised specification are filed which replace the original specification pages 4, 5 and 9. The specification has been adapted to the new claim version and a short description of the cited prior art document D1 has been included. Moreover, the wording "true spirit and" on page 9 has been deleted.

The new claim version includes a new independent system claim 1, a new independent network element claim 7 and a new independent method claim 11. The new dependent claims 2 to 6 and 8 to 10 correspond to the original claims 2, 3 and 5 to 7 and 9, 10 and 12, respectively. In the new claim version, the apparatus claims have been amended in order to overcome the objection raised by the Examining Division under item VIII.4 of the present Written Opinion.

Deutsche Bank München Kto. 286 1060 BLZ 700 700 10
Dresdner Bank München Kto. 3939 844 BLZ 700 800 00
Postbank München Kto. 67043 804 BLZ 700 100 80
Daikichi-Kangyo Bank München Kto. 8104233007 BLZ 300 207 00
Sanwa Bank Düsseldorf Kto. 500 047 BLZ 301 307 00

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Telefax (G3): +49 89 532611
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Bavariaring 4-6, 80336 München

The new independent claims have been amended by incorporating the feature that the transmission conditions comprise radio conditions which can be detected and according to which the window size can be modified, in order to provide novelty and inventive step of the independent claims over the cited prior art document D1.

Document D1 discloses a BUC (Buffer Utilization Control) algorithm which is executed in a so called BUC gateway. Moreover, document D1 discloses a signaling mechanism called RFCN (Reverse Feedback Congestion Notification). RFCN is applicable to transport protocols using sliding window flow control, e.g. TCP. According to window flow control, the receiver transmits its available buffersize to the sender in a window-field in the ACK-header. The BUC algorithm may update the credit value in this window field to its computed window to control the transmission rate of a data-sender. According to document D1, each conversion maintains two per-conversation-queues at two distinct output-ports at the BUC gateway. From the view of a data-sender one of these per-conversation-queues is the "forward queue", i.e. the queue storing the packets sent by the data-sender. The other per-conversation-queue is the "backward queue", the queue storing the ACKs to be received by the data-sender. The RFCN algorithm requires that each forward queue has access to the data structures of its corresponding backward queue and vice versa. If used in combination with RFCN, the BUC algorithm calculates the window at the forward queue and sets the header field of ACKs at the corresponding backward queue, as illustrated in Fig. 1 of D1.

According to the subject matter of the new independent claims, radio conditions can be detected and the window size can be modified accordingly. In radio communications,

communication conditions change depending on weather conditions, multipath propagation and changing network conditions such as handovers.

In contrast thereto, that kind of changes do not happen in wireline communications. In other words, a difference between the subject matter of the new independent claims and document D1 lies in the element performing the buffering and window modification. For example, the BUC gateway according to document D1 is not able to detect radio conditions, and a person skilled in the art would not provide the BUC gateway with such abilities since in wireline communications changes due to radio conditions do not occur.

Moreover, with respect to item VIII.3 of the Written Opinion, the criticized wording seems to be correct since the sliding window mechanism allows the sender to send several packets before receiving an acknowledgment, but the receiver acknowledges each received data packet by an acknowledgment message.

In view of the above, due to the lack of a corresponding disclosure in the cited prior art, the subject matter of the new claim version is undoubtedly new and also involves the necessary inventive step over the prior art. Hence, the requirements of Art. 33(2) and (3) PCT are considered to be met.

H.-B. Pellmann
Patentanwalt
TBK-Patent

Enclosures

- New claims 1 to 11 in triplicate
- New specification pages 4, 5 and 9 in triplicate

09/980075

JOINT Rec'd PCT/PTO 28 NOV 2001

Enclosure of June 25, 2001

PCT Patent Application No.: PCT/EP99/03875
NOKIA NETWORKS OY
Our ref.: WO 23999

New claims 1 to 11

1. A packet data transmission network system comprising:
a receiver (1); and
a sender (2) for transmitting data packets to the receiver (1) through a packet data connection via a network element (3), the receiver being arranged to acknowledge each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; wherein
said network element (3) is arranged to buffer data packets transmitted by the sender (2) and examine and modify the header data;
characterized in that
said network element (3) is arranged to detect transmission conditions comprising radio conditions and modify the window size accordingly.
2. The system according to claim 1, wherein said network element (3) is arranged to modify the window size to a lower value when it detects a decreasing quality of transmission conditions.
3. The system according to claim 1 or 2, wherein said network element (3) is arranged to quit modifying the window size when it detects that the quality of transmission conditions is increasing and allow the receiver (1) to set the window size normally.

4. The system according to any one of claims 1 to 3, wherein the transmission conditions detected by said network element (3) comprise buffering conditions of data packets at said network element (3).

5. The system according to any one of claims 1 to 4, wherein the packet data connection is a TCP/IP connection.

6. The system according to any one of claims 1 to 6, wherein said network element (3) is an SGSN network element for performing header compression.

7. A network element (3) in a packet data transmission network system, comprising:

buffering means for buffering data packets transmitted by a sender (2) to a receiver (1) through a packet data connection, the receiver being arranged to acknowledge each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; and

examining means for examining and modifying the header data;

characterized by

detecting means for detecting transmission conditions comprising radio conditions; and

modifying means for modifying the window size according to the detected transmission conditions.

8. The network element according to claim 7, wherein said modifying means is arranged to modify the window size to a lower value when said detecting means detects a decreasing quality of transmission conditions.

9. The network element according to claim 7 or 8, wherein said modifying means is arranged to quit modifying the window size when said detecting means detects that the quality of transmission conditions are increasing.

10. The network element according to any one of claims 7 to 9, wherein the transmission conditions detected by said detecting means comprise buffering conditions of data packets at said buffering means.

11. A packet data transmission method comprising the steps of:

transmitting data packets from a sender (2) to a receiver (1) through a packet data connection via a network element (3), the receiver acknowledging each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; and

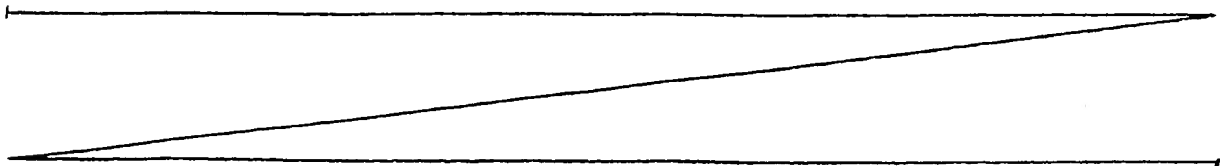
buffering, in said network element (3), transmitted data packets and examining and modifying the header data;
characterized by the step of:

detecting (S1, S2) transmission conditions comprising radio conditions and modifying (S3-S5) the window size accordingly.

operate with congested routers and not radio conditions so
that it does not work in a very optimal way with cellular
5 packet data because the characteristics of the service
degradation are very different.

By Ziegler T. et al.: 'Congestion Avoidance with BUC Gateways
and RFCN', IEEE International Performance, Computing and
10 Communications Conference, US, New York, IEEE, February 5,
1997, pp. 410-418, a BUC (Buffer Utilization Control)
algorithm is disclosed which is executed in a so called BUC
gateway. Moreover, a signaling mechanism called RFCN (Reverse
Feedback Congestion Notification) is disclosed. RFCN is
15 applicable to transport protocols using sliding window flow
control, e.g. TCP. According to window flow control, the
receiver transmits its available buffersize to the sender in
a window-field in the ACK-header. The BUC algorithm may
update the credit value in this window field to its computed
20 window to control the transmission rate of a data-sender. For
this purpose, each conversation maintains two per-conversation-
queues at two distinct output-ports at the BUC gateway. From
the view of a data-sender one of these per-conversation-
queues is the "forward queue", i.e. the queue storing the
25 packets sent by the data-sender. The other per-conversation-
queue is the "backward queue", the queue storing the ACKs to
be received by the data-sender. The RFCN algorithm requires
that each forward queue has access to the data structures of
its corresponding backward queue and vice versa. If used in
30 combination with RFCN, the BUC algorithm calculates the
window at the forward queue and sets the header field of ACKs
at the corresponding backward queue.

35



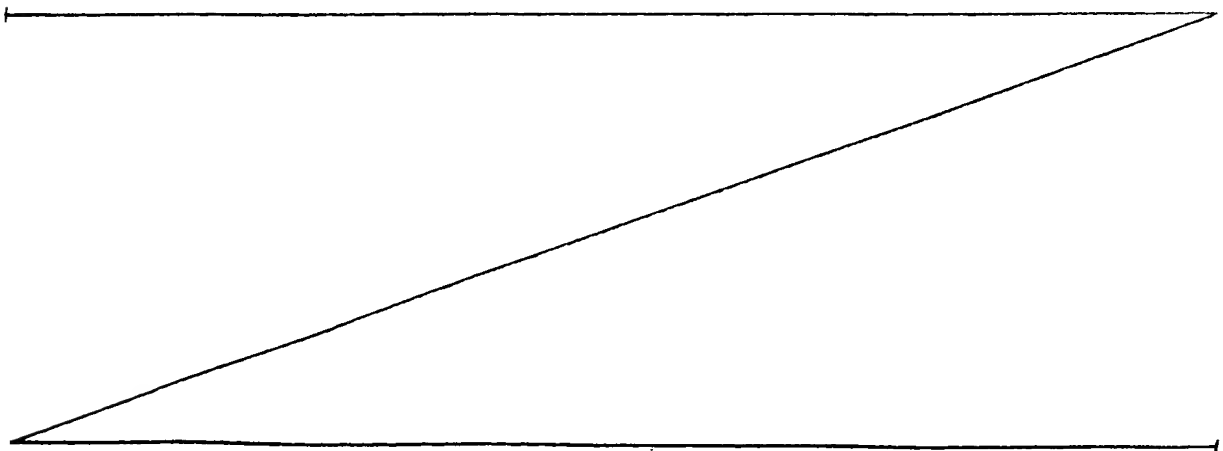
SUMMARY OF THE INVENTION

5 It is an object of the present invention to provide a reliable and fast adaptation of the transmission speed of a sender in a radio communication environment while unnecessary retransmissions are avoided.

10 According to the present invention, this object is achieved by a system according to claim 1, a network element according to claim 7 and a method according to claim 11.

According to the present invention, the information about the
15 receiving ability of a receiver can be sent to the sender right away or even in advance, in case decreasing conditions are detected in the mobile system.

Furthermore, according to the present invention, the
20 throughput and efficiency of TCP/IP connections through packet data in GPRS/3G is optimized. The present invention is fully compliant with existing TCP/IP stacks and requires therefore no modification of the involved parties. Only the
25 the header compression routine (or a routine logically close to the header compression) in the SGSN network element requires new code.



The present invention can be implemented in connection with the TCP/IP header compression in which the SGSN network element examines and modifies the TCP headers anyway. This makes the implementation of this invention quite easy.

5

According to the present invention, the throughput and efficiency of TCP/IP connections through packet data in GPRS/3G is optimized. The present invention is fully compliant with existing TCP/IP stacks and requires therefore
10 no modification of the involved parties. Only the header compression routine (or a routine logically close to the header compression) in the SGSN network element requires new code.

15 While the invention has been described with reference to a preferred embodiment, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications and applications may occur to those skilled in the art without departing from the scope
20 of the invention as defined by the appended claims.

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

LESON, Thomas, Johannes, Alois
Tiedtke-Bühling-Kinne
Bavariaring 4
D-80336 München
ALLEMAGNE

EINGEGANGEN
Patentanwälte
- 4. April 2001
TIEDTKE-BÜHLING-KINNE
& PARTNER (GbR)

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of mailing
(day/month/year) 03.04.2001

Applicant's or agent's file reference
WO 23999

REPLY DUE **within 3 month(s)**
from the above date of mailing

International application No.
PCT/EP99/03875

International filing date (day/month/year)
04/06/1999

Priority date (day/month/year)

International Patent Classification (IPC) or both national classification and IPC
H04L12/56

Applicant

NOKIA NETWORKS OY et al.

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain document cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: .

3.7.01 ✓ WVB.5. ✓

Name and mailing address of the international preliminary examining authority:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer / Examiner

Jimenez Hernandez, P

Formalities officer (incl. extension of time limits)

Barrio Baranano, A

Telephone No. +49 89 2399 8621



I. Basis of the opinion

1. With regard to the **elements** of the international application (Replacement *sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"*):

Description, pages:

1-9 as originally filed

Claims, No.:

1-13 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

WRITTEN OPINION

International application No. PCT/EP99/03875

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N) Claims 1,2,3,5,6,8,9,10,12,13

Inventive step (IS) Claims 1-13

Industrial applicability (IA) Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The subject-matter of independent claim 13, which is the broadest claim, is not novel, Art. 33 (1) and (2) PCT.
- 1.1 Claim 13 relates to a packet transmission method for use in a packet-switched network.

D1 = ZIEGLER T ET AL: 'CONGESTION AVOIDANCE WITH BUC (BUFFER UTILIZATION CONTROL) GATEWAYS AND RFCN (REVERSE FEEDBACK CONGESTION NOTIFICATION)' IEEE INTERNATIONAL PERFORMANCE, COMPUTING AND COMMUNICATIONS CONFERENCE, US, NEW YORK, IEEE, 5 February 1997 (1997-02-05), page 410-418 XP000753707 ISBN: 0-7803-3874-X, which relates to the same area of packet switched networking as the application, is considered as the closest prior art.

D1, in the terminology of claim 13, discloses a packet data transmission method comprising the steps of: transmitting data packets from a sender to a receiver through a packet data connection (page 411, left-hand column, lines 2-10) via a network element (page 410, left-hand column, lines 2-4), the receiver acknowledging each received data packet by an acknowledgment message (page 411, left-hand column, lines 10-11) containing header data comprising a window size, the number of transmitted bytes for which the sender has not received an acknowledgment from the receiver being not allowed to exceed the window size (page 410, left-hand column, lines 15-18); and buffering, in said network element, transmitted data packets (page 411, right-hand column, lines 21-27) and examining and modifying the header data (page 410, left-hand column, lines 18-21); characterized by the step of detecting transmission conditions (page 410, right-hand column, lines 30-35) and modifying the window size accordingly (page 411, right-hand column, lines 12-20, 29-38 and Fig. 1).

D1 therefore discloses all the features of claim 13.

If novelty should be disputed based on some minor difference of interpretation, it is pointed out that the subject-matter of claim 13 would in any case not involve an inventive step (Article 33(3) PCT), given that **D1** attempts to solve the same problem and describes the same type of solution as presently claimed in claim 13.

2. The subject-matter of independent claims 1 and 8, which correspond to claim 13, is not novel, Art. 33 (1) and (2) PCT.
 - 2.1 Claim 1 claims for a network characterized by using the method defined by claim 13 and adds no new features to the subject-matter of claim 13.
 - 2.2 Claim 8 claims for a network element characterized by implementing the method defined by claim 13 and adds no new features to the subject-matter of claim 13.
3. The additional features of the dependent claims 2-7, 9-12 do not add anything both novel and inventive to the independent claims.
 - 3.1 The additional features of the following dependent claims add no novel subject-matter to the independent claim, said features being already disclosed in **D1** (Art. 33(2) PCT):
 - Claims 2, 3, 9, 10, 5, 12: see page 411, left-hand column, lines 25-29 and right-hand column, lines 18-20.
 - Claims 6: see page 411, left-hand column, line 8.
 - 3.2 The additional features of the dependent claims 4, 7, 11 are common measures or variations and therefore add nothing of inventive significance to the independent claims (Art. 33(3) PCT).

Re Item VII

Certain defects in the international application

1. The independent claims should be in the two-part form vis-à-vis **D1**, Rule 6.3(b) PCT.

2. **D1** should be mentioned in the description, Rule 5.1(a)(ii) PCT.
3. The description should be adapted to any new claims, Rule 5.1(a)(III) PCT.

Re Item VIII

Certain observations on the international application

1. A single independent claim in each category should be filed (conciseness, Art. 6 PCT).
2. The wording "without departing from the true **spirit** and scope of the invention" on page 9, line 21 of the description casts doubts on the scope of the claims (Art. 6 PCT), see PCT International Preliminary Examination Guidelines, III-4.3a.
3. The wording "the receiver **acknowledging each received data packet by an acknowledgement message**" in the independent claims 1, 8 and 13 is not clear or supported by the description (Art. 6 PCT) since it may imply that every single data packet (eg TCP segment) must be acknowledged by a single acknowledgment message, i.e. a bi-univocal relationship between received data packets and acknowledgments. However the sliding window mechanism (eg TCP sliding window) upon which the application is based allows more than one data package to be acknowledged by a single acknowledgment message. 2
4. The apparatus claims 1, 2, 3, 8, 9, 10 are partially characterized by method features (eg claim 1 "the receiver acknowledging...", "said network element buffers data... and examines and modifies", "said network element (3) detects transmission conditions and modifies"), thus rendering the category of these claims unclear. This deficiency could be overcome by re-wording these features with "arranged to", eg "the receiver arranged to acknowledge...", etc. (Art. 6 PCT)

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

LESON, Thomas, Johannes, Alois
Tiedtke-Bühling-Kinne
Bavariaring 4
D-80336 München
ALLEMAGNE

RECEIVED
EINGEGANGEN

24. Aug. 2001

TBK - PATENT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year) 23.08.2001

Applicant's or agent's file reference
WO 23999

IMPORTANT NOTIFICATION

International application No.
PCT/EP99/03875

International filing date (day/month/year)
04/06/1999

Priority date (day/month/year)

Applicant
NOKIA NETWORKS OY et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer

Ahrens, R

Tel. +49 89 2399-8136



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference WO 23999		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP99/03875	International filing date (day/month/year) 04/06/1999	Priority date (day/month/year)
International Patent Classification (IPC) or national classification and IPC H04L12/56		
Applicant NOKIA NETWORKS OY et al.		



1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 23/11/2000	Date of completion of this report 23.08.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Jimenez Hernandez, P Telephone No. +49 89 2399 7938 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/03875

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*):

Description, pages:

1-3,6-8 as originally filed

4,5,9 as received on 28/06/2001 with letter of 25/06/2001

Claims, No.:

1-11 as received on 28/06/2001 with letter of 25/06/2001

Drawings, sheets:

1/2,2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP99/03875

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-11
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

- 2. Citations and explanations**
see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The subject-matter of independent claim 11, which is the broadest claim, does not involve an inventive step and claim 11 therefore does not meet the requirements of Art. 33 (3) PCT.
- 1.1 Claim 11 relates to a packet transmission method for use in a packet-switched network.

D1 = ZIEGLER T ET AL: 'CONGESTION AVOIDANCE WITH BUC (BUFFER UTILIZATION CONTROL) GATEWAYS AND RFCN (REVERSE FEEDBACK CONGESTION NOTIFICATION)' IEEE INTERNATIONAL PERFORMANCE, COMPUTING AND COMMUNICATIONS CONFERENCE,US,NEW YORK, IEEE,5 February 1997 (1997-02-05), page 410-418 XP000753707 ISBN: 0-7803-3874-X, which relates to the same area of packet switched networking as the application, is considered as the closest prior art.

D1, in the terminology of claim 11, discloses a packet data transmission method comprising the steps of: transmitting data packets from a sender to a receiver through a packet data connection (page 411, left-hand column, lines 2-10) via a network element (page 410, left-hand column, lines 2-4), the receiver acknowledging each received data packet by an acknowledgment message (page 411, left-hand column, lines 10-11) containing header data comprising a window size, the number of transmitted bytes for which the sender has not received an acknowledgment from the receiver being not allowed to exceed the window size (page 410, left-hand column, lines 15-18); and buffering, in said network element, transmitted data packets (page 411, right-hand column, lines 21-27) and examining and modifying the header data (page 410, left-hand column, lines 18-21); characterized by the step of detecting transmission conditions (page 410, right-hand column, lines 30-35) and modifying the window size accordingly (page 411, right-hand column, lines 12-20, 29-38 and Fig. 1).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP99/03875

- 1.2 Claim 11 differs from **D1** only in that the transmission conditions comprise **radio conditions**.
- 1.3 The objective problem is how to best apply the method disclosed in **D1** to wireless communications.
- 1.4 Contrary to applicant's arguments, the skilled person would find it straightforward to apply the method disclosed in **D1** to a wireless system by including radio conditions in the transmission conditions and thus arrive at the subject-matter of claim 11 since:
- error detection and correction measures applied in wireless and in wireline system are analogous, eg sliding window mechanism. The transmission condition detection in **D1** (eg packet loss detection) finds in a straightforward way analogous conditions and effects to be dealt with in a wireless communication (eg bit error due to multipath, handover, weather conditions, etc.)
 - the subject-matter of claim 11 provides no additional technical features to the known method in **D1**, in particular regarding what specific radio conditions are concerned, which may eventually have been considered a special technical feature providing an inventive step.
 - the technical problem regarding optimization of a packet-switched transmission system in an error-prone environment is common to wireless and wireline systems. **D1** attempts to solve the same problem and describes the same type of solution as presently claimed in claim 11.
 - there is no technical reason to prejudice the application of a method disclosed in one of the subfields (wireless/wireline) in the other one.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP99/03875

2. The subject-matter of independent claims 1 and 7, which correspond to claim 11, is not inventive, Art. 33 (1) and (3) PCT.
 - 2.1 Claim 1 claims for a network characterized by using the method defined by claim 11 and adds no new features to the subject-matter of claim 11.
 - 2.2 Claim 7 claims for a network element characterized by implementing the method defined by claim 11 and adds no new features to the subject-matter of claim 11.
3. The additional features of the dependent claims 2-6, 8-10 do not add anything inventive to the independent claims.
 - 3.1 The additional features of the following dependent claims add no inventive subject-matter to the independent claim, said features being already disclosed in **D1** (Art. 33(3) PCT):
 - Claims 2, 3, 4 and corresponding claims 8, 9, 10: see page 411, left-hand column, lines 25-29 and right-hand column, lines 18-20.
 - Claim 5: see page 411, left-hand column, line 8.
 - 3.2 The additional features of the dependent claim 6 (network element being an SGSN) is an analogous use and therefore adds nothing of inventive significance to the independent claims (Art. 33(3) PCT) (see also PCT Internal Preliminary Examination Guidelines, IV-8.8 (A1)(v)).

operate with congested routers and not radio conditions so
that it does not work in a very optimal way with cellular
5 packet data because the characteristics of the service
degradation are very different.

By Ziegler T. et al.: 'Congestion Avoidance with BUC Gateways
and RFCN', IEEE International Performance, Computing and
10 Communications Conference, US, New York, IEEE, February 5,
1997, pp. 410-418, a BUC (Buffer Utilization Control)
algorithm is disclosed which is executed in a so called BUC
gateway. Moreover, a signaling mechanism called RFCN (Reverse
Feedback Congestion Notification) is disclosed. RFCN is
15 applicable to transport protocols using sliding window flow
control, e.g. TCP. According to window flow control, the
receiver transmits its available buffersize to the sender in
a window-field in the ACK-header. The BUC algorithm may
update the credit value in this window field to its computed
20 window to control the transmission rate of a data-sender. For
this purpose, each conversion maintains two per-conversation-
queues at two distinct output-ports at the BUC gateway. From
the view of a data-sender one of these per-conversation-
queues is the "forward queue", i.e. the queue storing the
25 packets sent by the data-sender. The other per-conversation-
queue is the "backward queue", the queue storing the ACKs to
be received by the data-sender. The RFCN algorithm requires
that each forward queue has access to the data structures of
its corresponding backward queue and vice versa. If used in
30 combination with RFCN, the BUC algorithm calculates the
window at the forward queue and sets the header field of ACKs
at the corresponding backward queue.

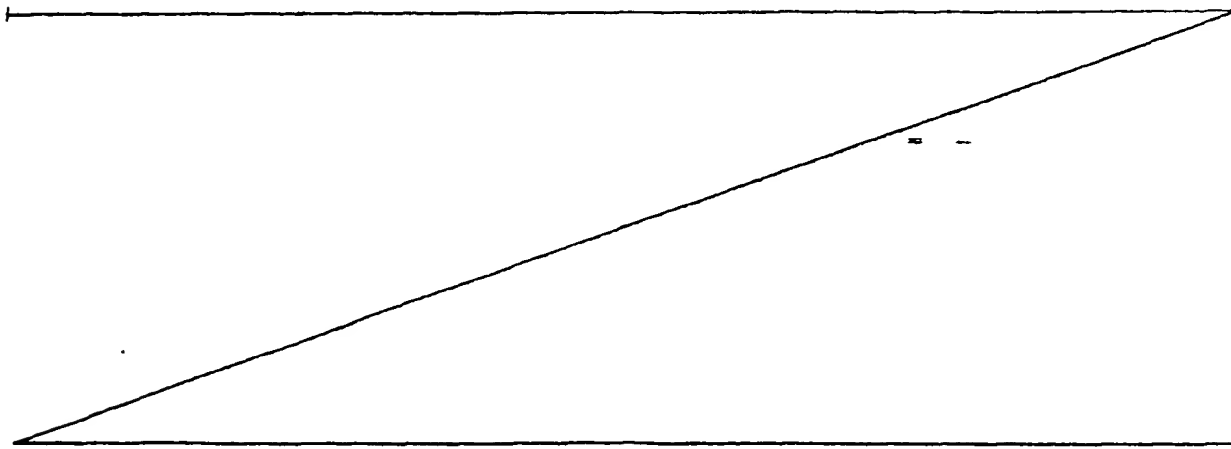
35

SUMMARY OF THE INVENTION

- 5 It is an object of the present invention to provide a reliable and fast adaptation of the transmission speed of a sender in a radio communication environment while unnecessary retransmissions are avoided.
- 10 According to the present invention, this object is achieved by a system according to claim 1, a network element according to claim 7 and a method according to claim 11.

According to the present invention, the information about the
15 receiving ability of a receiver can be sent to the sender right away or even in advance, in case decreasing conditions are detected in the mobile system.

Furthermore, according to the present invention, the
20 throughput and efficiency of TCP/IP connections through packet data in GPRS/3G is optimized. The present invention is fully compliant with existing TCP/IP stacks and requires therefore no modification of the involved parties. Only the header compression routine (or a routine logically close to
25 the header compression) in the SGSN network element requires new code.



The present invention can be implemented in connection with the TCP/IP header compression in which the SGSN network element examines and modifies the TCP headers anyway. This makes the implementation of this invention quite easy.

5

According to the present invention, the throughput and efficiency of TCP/IP connections through packet data in GPRS/3G is optimized. The present invention is fully compliant with existing TCP/IP stacks and requires therefore
10 no modification of the involved parties. Only the header compression routine (or a routine logically close to the header compression) in the SGSN network element requires new code.

15 While the invention has been described with reference to a preferred embodiment, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications and applications may occur to those skilled in the art without departing from the scope
20 of the invention as defined by the appended claims.

Enclosure of June 25, 2001

PCT Patent Application No.: PCT/EP99/03875
NOKIA NETWORKS OY
Our ref.: WO 23999

New claims 1 to 11

1. A packet data transmission network system comprising:
a receiver (1); and
a sender (2) for transmitting data packets to the receiver (1) through a packet data connection via a network element (3), the receiver being arranged to acknowledge each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; wherein
said network element (3) is arranged to buffer data packets transmitted by the sender (2) and examine and modify the header data;
characterized in that
said network element (3) is arranged to detect transmission conditions comprising radio conditions and modify the window size accordingly.
2. The system according to claim 1, wherein said network element (3) is arranged to modify the window size to a lower value when it detects a decreasing quality of transmission conditions.
3. The system according to claim 1 or 2, wherein said network element (3) is arranged to quit modifying the window size when it detects that the quality of transmission conditions is increasing and allow the receiver (1) to set the window size normally.

4. The system according to any one of claims 1 to 3, wherein the transmission conditions detected by said network element (3) comprise buffering conditions of data packets at said network element (3).

5. The system according to any one of claims 1 to 4, wherein the packet data connection is a TCP/IP connection.

6. The system according to any one of claims 1 to 6, wherein said network element (3) is an SGSN network element for performing header compression.

7. A network element (3) in a packet data transmission network system, comprising:

buffering means for buffering data packets transmitted by a sender (2) to a receiver (1) through a packet data connection, the receiver being arranged to acknowledge each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; and

examining means for examining and modifying the header data;

characterized by

detecting means for detecting transmission conditions comprising radio conditions; and

modifying means for modifying the window size according to the detected transmission conditions.

8. The network element according to claim 7, wherein said modifying means is arranged to modify the window size to a lower value when said detecting means detects a decreasing quality of transmission conditions.

9. The network element according to claim 7 or 8, wherein said modifying means is arranged to quit modifying the window size when said detecting means detects that the quality of transmission conditions are increasing.

10. The network element according to any one of claims 7 to 9, wherein the transmission conditions detected by said detecting means comprise buffering conditions of data packets at said buffering means.

11. A packet data transmission method comprising the steps of:

transmitting data packets from a sender (2) to a receiver (1) through a packet data connection via a network element (3), the receiver acknowledging each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; and

buffering, in said network element (3), transmitted data packets and examining and modifying the header data; **characterized by the step of:**

detecting (S1, S2) transmission conditions comprising radio conditions and modifying (S3-S5) the window size accordingly.

REPLACED BY
PART 34 AMDT
ART 34

operate with congested routers and not radio conditions so that it does not work in a very optimal way with cellular packet data because the characteristics of the service degradation are very different.

5

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a reliable and fast adaptation of the transmission speed of a sender while unnecessary retransmissions are avoided.

According to the present invention, this object is achieved by a packet data transmission network system comprising:

a receiver; and

15 a sender for transmitting data packets to the receiver through a packet data connection via a network element, the receiver acknowledging each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender has not received an acknowledgment from the receiver being not allowed to exceed the window size; wherein

said network element buffers data packets transmitted by the sender and examines and modifies the header data; characterized in that

25 said network element detects transmission conditions and modifies the window size accordingly.

Moreover, the object is achieved by a packet data transmission method comprising the steps of:

30 transmitting data packets from a sender to a receiver through a packet data connection via a network element, the receiver acknowledging each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender has not received an acknowledgment from the receiver being not allowed to exceed the window size; and

buffering, in said network element, transmitted data packets and examining and modifying the header data; characterized by the step of:

5 detecting transmission conditions and modifying the window size accordingly.

In addition, the object is achieved by a network element in a packet data transmission network system, comprising:

10 buffering means for buffering data packets transmitted by a sender to a receiver through a packet data connection, the receiver acknowledging each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender has not received an acknowledgment from the receiver
15 being not allowed to exceed the window size; and

examining means for examining and modifying the header data;

characterized by

20 detecting means for detecting transmission conditions; and

modifying means for modifying the window size according to the detected transmission conditions.

25 According to the present invention, the information about the receiving ability of a receiver can be sent to the sender right away or even in advance, in case decreasing conditions are detected in the mobile system.

30 Furthermore, according to the present invention, the throughput and efficiency of TCP/IP connections through packet data in GPRS/3G is optimized. The present invention is fully compliant with existing TCP/IP stacks and requires therefore no modification of the involved parties. Only the header compression routine (or a routine logically close to
35 the header compression) in the SGSN network element requires new code.

The present invention can be implemented in connection with the TCP/IP header compression in which the SGSN network element examines and modifies the TCP headers anyway. This
5 makes the implementation of this invention quite easy.

According to the present invention, the throughput and efficiency of TCP/IP connections through packet data in GPRS/3G is optimized. The present invention is fully
10 compliant with existing TCP/IP stacks and requires therefore no modification of the involved parties. Only the header compression routine (or a routine logically close to the header compression) in the SGSN network element requires new
code.

15

While the invention has been described with reference to a preferred embodiment, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications and applications may occur
20 to those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims.

CLAIMS:

1. A packet data transmission network system comprising:
a receiver (1); and
5 a sender (2) for transmitting data packets to the receiver (1) through a packet data connection via a network element (3), the receiver acknowledging each received data packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for
10 which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; wherein
said network element (3) buffers data packets transmitted by the sender (2) and examines and modifies the
15 header data;
characterized in that
said network element (3) detects transmission conditions and modifies the window size accordingly.
- 20 2. The system according to claim 1, wherein said network element (3) modifies the window size to a lower value when it detects a decreasing quality of transmission conditions.
3. The system according to claim 1 or 2, wherein said network
25 element (3) quits modifying the window size when it detects that the quality of transmission conditions is increasing and allows the receiver (1) to set the window size normally.
4. The system according to any one of claims 1 to 3, wherein
30 the transmission conditions detected by said network element (3) comprise radio conditions.
5. The system according to any one of claims 1 to 3, wherein
the transmission conditions detected by said network element
35 (3) comprise buffering conditions of data packets at said network element (3).

6. The system according to any one of claims 1 to 5, wherein the packet data connection is a TCP/IP connection.

5 7. The system according to any one of claims 1 to 6, wherein said network element (3) is an SGSN network element performing header compression.

8. A network element (3) in a packet data transmission
10 network system, comprising:

buffering means for buffering data packets transmitted by a sender (2) to a receiver (1) through a packet data connection, the receiver acknowledging each received data packet by an acknowledgment message containing header data
15 comprising a window size, the number of transmitted bytes for which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; and

examining means for examining and modifying the header
20 data;

characterized by

detecting means for detecting transmission conditions;
and

modifying means for modifying the window size according
25 to the detected transmission conditions.

9. The network element according to claim 8, wherein said modifying means modifies the window size to a lower value when said detecting means detects a decreasing quality of
30 transmission conditions.

10. The network element according to claim 8 or 9, wherein said modifying means quits modifying the window size when said detecting means detects that the quality of transmission
35 conditions are increasing.

11. The network element according to any one of claims 8 to 10, wherein the transmission conditions detected by said detecting means comprise radio conditions.
- 5 12. The network element according to any one of claims 8 to 10, wherein the transmission conditions detected by said detecting means comprise buffering conditions of data packets at said buffering means.
- 10 13. A packet data transmission method comprising the steps of:
- transmitting data packets from a sender (2) to a receiver (1) through a packet data connection via a network element (3), the receiver acknowledging each received data
- 15 packet by an acknowledgment message containing header data comprising a window size, the number of transmitted bytes for which the sender (2) has not received an acknowledgment from the receiver (1) being not allowed to exceed the window size; and
- 20 buffering, in said network element (3), transmitted data packets and examining and modifying the header data;
- characterized by the step of:**
- detecting (S1, S2) transmission conditions and modifying (S3-S5) the window size accordingly.